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The 2003 Loggerhead Shrike Survey in Alberta

Alberta Species at Risk Report No. 93

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

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David R. C. Prescott

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Main Floor, Great West Life Building
9920 108 Street
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EXECUTIVE SUMMARY

Populations of the Loggerhead Shrike (*Lanius ludovicianus*) have declined in recent years. In western Canada, populations (*L. l. exubitorides*) are now listed by the Committee on the Status of Endangered Wildlife in Canada as being "Threatened", whereas in Alberta, the species is considered to be of "Special Concern". Since 1987, a prairie-wide roadside survey has been conducted every five years to monitor populations of the Loggerhead Shrike. This report summarizes results of the 2003 survey conducted in Alberta, and compares results with surveys conducted in 1987 and 1998 (a 1993 survey conducted in Manitoba and Saskatchewan was not done in this province). The 2003 survey doubled the effort expended in previous years (8095 km on 31 routes versus 3802 km on 16 routes), and collected additional information on detection distances and probability to derive an estimate of population size for the province.

The 2003 survey was conducted between 17 June and 14 July by 19 different observers who drove routes at 50-70 km/hr to document locations of shrikes. The distance to shrikes when first detected, their behavior, and broad habitat descriptions were recorded. Following the initial survey, two new routes that intersected known shrike locations were driven by naïve observers to determine the percentage of occupied sites that were overlooked during standard roadside surveys.

Observers recorded 168 shrikes at 144 unique locations, for a linear density of 1.78 indicated pairs (IP)/100 km on the 31 routes. This value was 10.9% lower than was observed during the 1998 survey (1.99 IP/100 km). If only the same 16 routes surveyed in both years are compared, the density in 2003 (1.22 IP/100 km) was 38.5% lower than in 1998. Despite these declines, populations remain substantially higher than in 1987 (0.48 IP/100 km). Shrike densities have shifted over the three surveys, possibly in response to recent drought. However, populations remain highest in the east-central parts of the province (map sheets 72L and 72M). Shrikes were found in a wide variety of upland and grassland types, with most birds being associated with mixed trees and shrubs or shelterbelts. Most nests (62.5%) were in willow (*Salix* sp.) shrubs. Birds were detected up to 220 m from the road, but 84.5% were within 100 m when first observed. Repeat visits to known locations found that shrikes had a 34% chance of being encountered if present.

Population estimates in each 1:250,000 map sheet were derived from: (1) observed linear density of shrikes within 100 m of the road, (2) total km of road present in each map sheet (derived from GIS analysis), (3) detectability correction, and (4) proportion of shrikes on the landscape that occur within 100 m of roads (derived from data in Bjorge and Prescott [1996] and Bjorge and Kiliaan [1997]). Estimates summed over the eight map sheets that constitute the provincial range of the Loggerhead Shrike suggest an overall population of 8,327 pairs in Alberta. This estimate is higher than previous values of up to 5000 pairs derived from intensive inventories of sample blocks.

1.0 INTRODUCTION

Populations of the Loggerhead Shrike (*Lanius ludovicianus*) have declined in recent years across most of North America (Sauer et al. 2004). In Canada, the eastern subspecies (*L. l. migrans*) is now listed as an "Endangered" species by the Committee on the Status of Endangered Wildlife in Canada, whereas western populations (*L. l. exubitorides*) are considered to be "Threatened" (COSEWIC 2001). In Alberta, the species is listed as a species of "Special Concern" (Alberta Sustainable Resource Development 2004). Populations in this province, as in many other jurisdictions, have declined since the 1950s, and recent estimates suggest that provincial population is about 3000 pairs (Prescott and Bjorge 1999).

The management of all species at risk requires good knowledge of population size, distribution and trends. A variety of surveys have been conducted for the Loggerhead Shrike in Alberta over the past few years (Telfer et al. 1989, Bjorge and Prescott 1996, Collister 1996, Bjorge and Kiliaan 1997, Kiliaan and Prescott 2002). Perhaps the most useful is the prairie-wide roadside survey conducted at five-year intervals since 1987 (the 1993 survey was not conducted in this province). Past surveys included approximately 10,000 km of road routes (approximately 3800 km of these were in Alberta), and provided valuable information on population trends and shifts in population density over time. These surveys have shown that populations in Alberta have increased over the past 15 years, while decreasing substantially in Manitoba and remaining fairly constant in Saskatchewan (Johns et al. 2002). These roadside surveys do not, however, provide any estimates of population size.

In 2003, the prairie-wide population survey for Loggerhead Shrikes was repeated. Our goal in Alberta was to increase coverage of roadside routes, and to collect additional information that would allow us to calculate a population estimate for the province. The results of that survey are reported herein.

2.0 METHODS

2.1 Field Surveys

Surveys were conducted along roads within the range of the Loggerhead Shrike in Alberta. In previous surveys, two road routes, averaging about 260 km in length, were established in each of the eight, 1:250,000 map sheets in the southeastern part of the province (total of 3802 km). For the 2003 survey, the same routes were maintained, but an additional two routes were placed in all map sheets, with the exception of sheet 72L in the southeastern corner of the province, where a paucity of roads permitted the addition of only one route (see Figure 1). The addition of these routes was intended to better monitor local shifts in the population between survey periods, to potentially detect previously unknown concentrations of breeding populations, and to derive population estimates (see below) from a higher percentage of the actual breeding population. The total distance covered by the 31 routes was 8095 km.

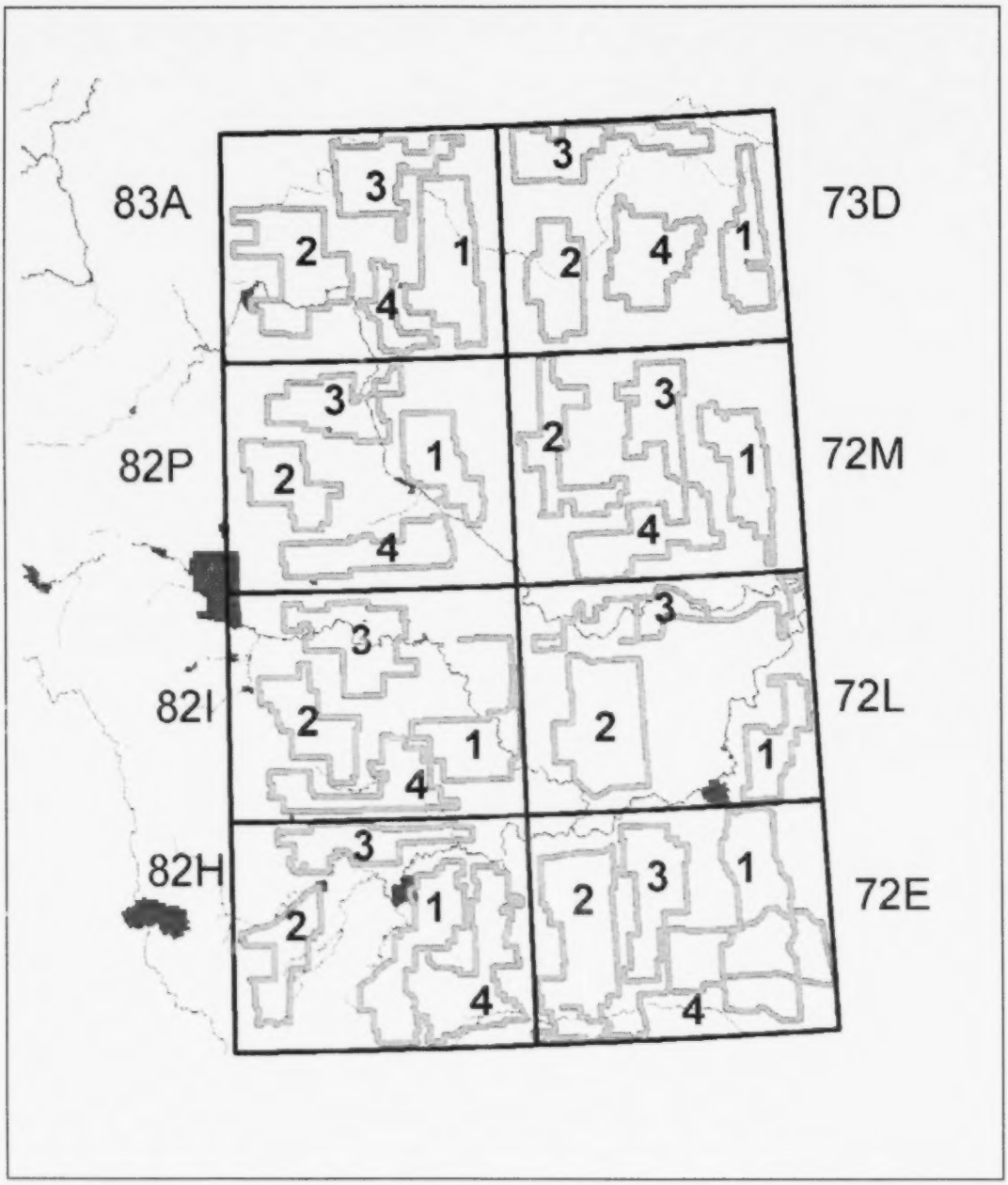

Figure 1. Location of road survey routes used in the 2003 Loggerhead Shrike survey in Alberta. In each map sheet, routes 1 and 2 were also surveyed in previous provincial inventories in 1987 and 1998. Routes 3 and 4 in each map sheet were added for the 2003 survey.

Surveys were conducted using identical methodology to that used in the previous three surveys conducted across the prairies (two in Alberta; see Telfer et al. 1989, Johns et al. 2002). Observers drove routes at a speed of 50-70 km/hr between mid-June and mid-July, and recorded the presence of shrikes. Each occupied site was assumed to represent a breeding pair, whether or not a pair was observed. Surveys were not conducted during inclement weather or temperatures >25°C. In Alberta, we also asked observers to collect additional information required to derive population estimates (see below), to quantify habitat use, and to help interpret survey results. These observations were gathered not only during the actual survey, but also from incidental observations of shrikes gathered during the 2003 nesting season. These measurements included:

- Distance from the road to the shrike when first detected by the observer
- Behavior of the shrike when first observed
- General habitat description of woody vegetation (abandoned farm, occupied farm, dry slough, aspen groves, shelterbelt, thorny buffalo berry, upland willow, mixed shrub/tree, other)
- Percentage of different grassland types (native, tame, cultivated) within a 200 m radius of the observation site
- Type of nesting shrub, if nest was observed or strongly inferred from adult behavior (generally carrying food)

2.2 Population Estimate

A population estimate (# indicated pairs) for the province was derived from four metrics:

(1) Observed number of shrikes/km of road surveyed in each map sheet. The observed number/km was reduced to include only those shrikes found within the effective survey distance from the road. This distance was subjectively determined by plotting detection distances of all shrikes when first observed, and is considered to be the distance over which shrikes, if flying or sitting on prominent perches, will be readily visible to the observer using the standard driving protocol. A single estimate was used for the entire study area.

(2) Number of kilometers of road present on the landscape. This was derived for each map sheet using GIS analysis (using ArcView 3.1).

(3) Detectability of shrikes. This metric estimates the percentage of shrikes actually present that are missed by the observer. To calculate this value, observers who were unaware of the location of shrikes resurveyed routes (using standard methodology) that intersected locations known to be occupied by shrikes. Such surveys were conducted within seven days of the original inventory along those routes. The proportion of known locations that were detected by the observer on the repeat visit was used as a detectability correction.

(4) Estimated proportion of the shrike population that is found within the effective detection distance from the road. Shrike habitat is not randomly distributed across the landscape. Bjorge and Prescott (1996) estimated that 52.2% of shrikes in Alberta range occur within 200 m of roads, due to the disproportionate occurrence of suitable habitat (farmsteads, shelterbelts, shrubs). This percentage

was modified, based on determination of the effective survey distance described in 1, above.

The population estimate (# indicated pairs) was derived for each of the eight surveyed map sheets according to:

$$IP = \frac{(\#\ observed\ IP/km) * (km\ of\ roads\ in\ map\ sheet) * (detectability\ correction)}{proportion\ of\ shrikes\ within\ effective\ detection\ distance.}$$

The value derived from each map sheet was summed to produce a provincial population estimate.

All records of shrikes observed during this inventory, including incidental observations made during 2003, were entered into the Biodiversity/Species Observation Database (BSOD), maintained by Alberta Fish and Wildlife Division.

3.0 RESULTS

3.1 Field Surveys

A total of 19 observers from Alberta Fish and Wildlife and the Alberta Conservation Association spent 174 hours surveying the 31 shrike routes between 17 June and 14 July 2003. These routes represented approximately 10.4% of available roads in the provincial study area, with percentages in individual map sheets ranging from 7.2% (Map 83A) to 19.2% (Map 72L) (Table 1). Observers encountered 168 shrikes (120 single birds, 24 pairs) at 144 unique sites, for a total of 1.78 indicated pairs [IP]/100 km of route. The highest linear density of shrikes was found in map sheets 72L (5.01 IP/100km) and 72M (4.48 IP/100 km), with the lowest number being found in sheet 82H (0.09 IP/100 km) (Table 1). The observed value of 1.78 indicated pairs/100 km in 2003 is 10.6% less than the 1.99 pairs/100 km reported in 1998. When only the same 16 routes surveyed in both years are considered, populations declined by 38.5% to 1.22 pairs/100 km between 1998 and 2003 (Table 2). Declines were marked in map sheets 72L, 72M, 82I and 82P, whereas relatively large increases were recorded in map sheets 73D and 83A.

Shrikes were observed in a wide variety of woody vegetation, with the majority of 204 unique sites encountered during the 2003 breeding season being described as mixed trees/shrubs (20.1%) or shelterbelts (19.6%). The remaining sites were described as being upland willow (14.7%), dry slough margins (13.2%), occupied farmsteads and thorny buffaloberry (11.8% each), abandoned farmsteads (4.4%), aspen groves (1.0%), wet slough margins and sagebrush (0.5% each). No apparent woody vegetation was present within 200 m of 5 (2.5%) sites. Thirty-two nests were found during the 2003 nesting season. The vast majority of these were in willow shrubs (62.5%), followed by thorny buffaloberry (15.6%), caragana and white spruce (6.3% each), and cottonwood, elm and rose (3.1% each). Overall, grasslands within 200 m of sighting locations

Table 1. Summary of Loggerhead Shrike roadside survey results in each of eight, 1:250,000 map sheets in southeastern Alberta in 2003.

Map Sheet	# Transects	Total km Surveyed	Total Roads in Map Sheet (km)	% Road Surveyed	Total Birds	IP	IP/100 km[1]	Population Estimate (pairs)[2]
72E	4	1164	8732	13.3	24	18	1.55	1016.5
72L	3	938	4875	19.2	54	47	5.01	1838.9
72M	4	1026	7175	14.3	49	46	4.48	2421.7
73D	4	883	10796	8.2	10	8	0.91	736.4
82H	4	1086.5	10545	10.3	2	1	0.09	73.1
82I	4	1126	10460	10.8	9	7	0.62	489.5
82P	4	894	12088	7.4	9	8	0.90	814.3
83A	4	977	13502	7.2	11	9	0.92	936.4
TOTAL	31	8094.5	78173	10.4	168	144	1.78	8326.8

[1] For calculation of population estimates, these values are converted to IP/km, and multiplied by 0.845 to correct for birds found within 100 m of the road (see text).

[2] See text for calculations

Table 2. Number of indicated breeding pairs (IP) per 100 km of road, and percentage change in population size among three roadside surveys conducted in Alberta. Values are based only on the 16 routes (2 per map sheet) conducted during each of the surveys, and omit the 15 new routes added to Alberta surveys in 2003.

	IP/100 km			% change[1]	
Map sheet	1987	1998	2003	1987-2003	1998-2003
72E	0.82	0.82	0.86	5.4	5.4
72L	0.95	5.24	2.34	146.2	-55.3
72M	1.85	5.19	2.72	47.0	-47.5
73D	0.00	0.95	1.72	++	81.8
82H	0.00	0.00	0.00	N/C	N/C
82I	0.22	2.15	0.00	-100.0	-100.0
82P	0.00	1.58	0.56	++	-64.5
83A	0.00	0.00	1.33	N/C	++
OVERALL	0.48	1.99	1.22	154.8	-38.5

[1] ++ denotes birds now present where previously absent. N/C=No change.

(n=204) were 36.1% native grass, 21.5% tame grass, and 42.4% cultivation. However, there was much variability among sites in terms of grassland cover. Forty sites (19.6%) contained only native grass, whereas cultivation and tame pasture were the only cover types present at 26 (12.7%) and 13 (6.4%) sites, respectively.

Most shrikes were perched on trees or shrubs when first observed (53.5% of 172 observations), with an additional 16.3% being perched on anthropogenic structures such as power lines, fences or road signs. Flying birds represented 27.3% of initial encounters.

3.2 Population Estimate

Birds were detected up to 220 m from the road, although 84.5% of observations (total n=155) were made at distances of 100 m or less (Figure 2). The effective survey distance used in the estimation of population size was therefore considered to be 100 m, and the observed IP/km found during the survey was multiplied by 0.845 to eliminate birds found at distances beyond 100 m. Because the effective survey distance was found to be half of that assumed by Bjorge and Prescott (1996), we reexamined their raw data and that of Bjorge and Kiliaan (1997), and determined that approximately 33% of shrikes in their survey blocks were found within 100 m of roads. Repeat surveys to determine a correction value for detectability occurred on two routes totaling 516 km and comprising 53 known shrike locations. Eighteen shrikes were detected (34.0%), so we assumed that there were 2.94 times (i.e., the detectability correction factor) as many shrikes present on roadside routes than were observed during a single survey. Not surprisingly, the repeat visits revealed 28 occupied locations along these routes that were missed on the first surveys.

Combining the observed linear density of shrikes in each map sheet with these correction factors, a total provincial population of 8,327 pairs of shrikes was calculated. The largest population occurred in map sheet 72 M (2422 pairs), and the lowest in map sheet 82H (73 pairs) (Table 1).

4.0 DISCUSSION

Loggerhead Shrike populations appear to have declined since the 1998 survey in Alberta. The observed value of 1.78 indicated pairs/100 km (on all 31 routes) in 2003 is 10.6% less than the linear density reported in 1998. The decline is even greater (38.5%) when only the same 16 routes surveyed in both years are considered. However, populations (based on 16 routes) in 2003 remain substantially higher (+154.8%) than those observed in the inaugural survey in 1987. These patterns are similar to that observed in Saskatchewan, where populations increased by 70% between 1987 and the subsequent survey in 1993 (Johns et al. 2002, L. Craig-Moore, pers. comm.), and have declined steadily since. Populations in that province declined 6.5% between 1998 and 2003,

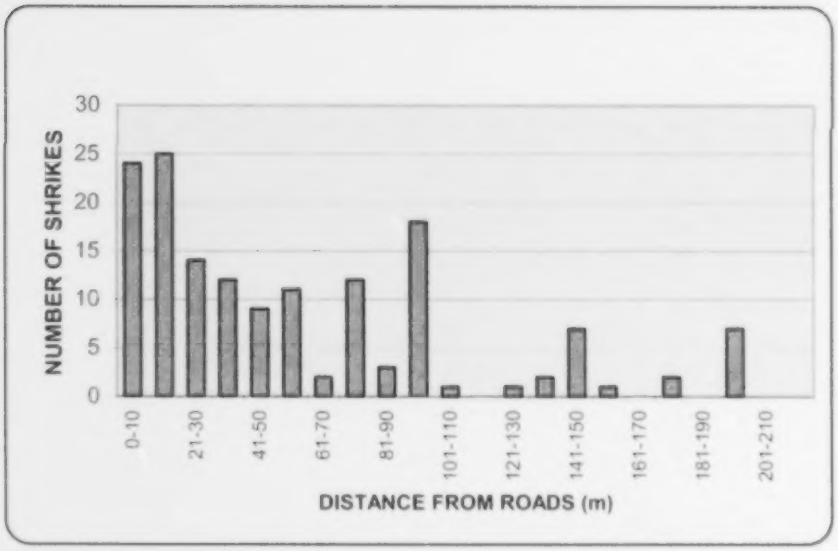

Figure 2. Distance at which Loggerhead Shrikes were initially detected from the road during surveys in 2003.

which is a smaller decline than observed in Alberta (L. Craig-Moore, pers. comm.)

Along with overall population declines in Alberta, there has also been a redistribution of populations within the province over time. Since 1987, there has been a general increase in all areas of the province with the exception of map sheet 82I, where populations on the original routes have disappeared, and in 72E where populations have remained fairly stable. Since 1998, there has been a general reduction in numbers in the central parts of the province (map sheets 72L, 72M, 82I and 82P), with populations increasing in the northern parts of the provincial range (map sheets 73D and 83A). The reason for these population shifts is unclear, but may be related to severe drought experienced over the past several years in southern Alberta.

The population estimate derived from the 2003 roadside survey (8327 pairs) suggests that Loggerhead Shrike numbers are substantially higher than previously thought. The only previous estimate was provided by Bjorge and Prescott (1996), who extrapolated a provincial population of up to 5000 pairs of birds based on intensive surveys of 26, 41.5 km^2 blocks within the range of the shrike in Alberta. One key difference between these block surveys and the 2003 roadside survey was that detectability was only considered in the latter survey. Although the detectability of birds in the block surveys is unknown (it is most certainly higher than during the roadside survey) application of a modest correction factor would render the two estimates to be of similar magnitude. In any case, it is clear that single visits to a survey unit miss a significant proportion of birds that are present, and will result in an underestimation of population size if not taken into account. We also note that the percentage of known shrike locations that are detected along roads

in this study (34.0%) was very similar to that (35.7%) determined during song playback experiments in 2002 (Prescott 2003), adding support to the notion that almost one in three breeding locations for shrikes are overlooked during roadside surveys.

Population estimates derived from roadside routes could be improved through a better understanding of the distribution of shrike habitat on the landscape, and how regional habitat differences influence the proportion of shrikes (and their detectability) that occur near roads. For example, habitat in drier areas of the province is likely to be concentrated near roads (i.e. shelterbelts, farmsteads) to a greater extent than occurs in moister areas such as the aspen parkland. Furthermore, detection of birds would be easier where vegetation is sparse (e.g. upland shrubs communities in dry grasslands), or where power lines and fences provide perch sites, relative to areas where habitat is more complex (e.g. parkland vegetation, farmsteads). Knowledge of appropriate correction factors for different areas of the province, or in broad categories of upland vegetation may result in more accurate extrapolations of roadside inventories to the landscape as a whole. In addition, the development of distance-detection functions (e.g. Buckland et al. 1993, Thomas et al. 2002) may would allow more rigorous quantification of population estimates, rather than assuming equal observability of birds within a fixed distance (as with the 100 m distance used in this study).

5.0 RECOMMENDATIONS/FUTURE DIRECTION

Despite the fact that Loggerhead Shrike populations in Alberta may be higher than previously thought, the population trend estimated from roadside surveys over the past 15 years, and from other efforts such as the Breeding Bird Survey (Sauer et al. 2004) shows that populations continue to decline throughout the species range. This trend requires that biologists continue to monitor populations in their jurisdictions, and to conduct research to better understand the factors responsible for this decline.

The five-year survey of Loggerhead Shrikes across the Canadian prairies provides a valuable source of information on wide-scale population trends and distribution. Continued participation in these surveys should be a high priority in Alberta. Furthermore, it has now been shown that such surveys can yield more than simply trend information. Application of, and refinement to, methodology used in this study could provide population estimates of birds in other Canadian jurisdictions where roadside surveys are conducted.

The prairie-wide survey results, including results presented here, are being prepared for publication as a Canadian Wildlife Service Progress Note, and will be available in late 2004 (L. Craig-Moore, pers. comm.). This publication will provide a thorough analysis and comparison of population trends and distribution of Loggerhead Shrikes on the Canadian prairies since 1987.

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